the source. But it is a curious fact that the two errors occurring on the undulatory theory ("aberration" and "equation of light") happen precisely to counteract each other; so that therefore the luminous source is seen in its *true* position, *i.e.*, in the *same* position as by the corpuscular theory. The fact of the two errors compensating each other therefore prevents this occurrence of error from serving as a visual test between the two theories. There is, however, a distinct objective difference between the two theories in this case, as regards the *position* of the telescope (previously referred to); but before recurring to this, we may consider more closely the mode in which the above compensation of the two errors is brought about.

8. It is well known that the effect of the error termed "aberration" is to make the luminous source appear *forwards* of the position it occupied when the wave left it, and this by an absolute amount equal to that traversed by the telescope during the time the light took to pass from the source to the telescope. But from the fact that the luminous source is in motion, the latter *is* actually at the time of observation situated *forwards* of the position it occupied when the wave left it, and by precisely the above amount (since the source is moving at the same velocity as the telescope). Hence the two errors will precisely compensate each other, and the luminous source will be seen through the telescope in its true position, *i.e.*, in the *same* position as by the corpuscular theory. But it is important to note that on the undulatory theory, the telescope, in order to receive the parallel beam emitted by the luminous source, must be placed *not* opposite the source, but somewhat backwards, to make up for the slanting track of the beam attendant on the motion of the luminous source. On the corpuscular theory, on the other hand (where the track of the beam of light is *normal* to the line of motion of the source), the telescope must be placed *opposite* the source in order to catch the beam. The *position* of the telescope in the two cases therefore constitutes a distinct physical difference between the two theories, which might serve as a test.[1]

9. The above considerations may suffice to show in a simple manner that important differences exist in the effects attendant on the motion of a luminous source on the corpuscular and undulatory theories of light, and that these differences would be *in principle* capable (supposing practical difficulties surmounted) of constituting a simple and decisive test between the two theories.

S. TOLVER PRESTON

GEOGRAPHICAL NOTES

THE Paris Geographical Society held last Friday its annual December meeting, at its hotel, under the presidency of Admiral La Roncière le Nourry. The report of the progress of geography was read by M. Maunoir, the secretary. M. de Ujfalvy delivered an address on the region of Central Asia which he visited, and which may be termed the extreme frontiers of the Russian empire, and which are just now attracting so much notice. This traveller will soon come to London to give the same address before the Royal Geographical Society. His exploration was made at the expense of the French Government. On the following Saturday a banquet took place at the Continental Hotel. The usual toasts were given. After dinner M. de Lesseps, who is very likely to be nominated president of the Society for 1879, at the April meeting, gave some account of his visit to Tunis with Capt. Roudaire, in order to investigate the conditions of the creation of the new Saharan Sea. M. de Lesseps described the whole scheme as being easily practicable for a sum of not more than 60,000,000 of francs. He said that the French extension telegraph system was extending all over Tunis and Tripoli, and that Arabs were accustomed to follow the telegraphic line as their camels travelled at a quicker rate when following its track. He intimated that the Egyptian telegraphic system was extending to the equator, and that he advised M. Cochery, the Director of French Postal Telegraphy, to extend it all over Sahara up to Senegal.

PETERMANN'S *Mittheilungen* (for so it will continue to be named) for December contains a long and careful account of Chartography at the Paris Exhibition; Dr. Carl Martin contributes a paper, based on Chilian sources, on the Chonos Archipelago, which is accompanied by a map. An excellent paper on the present condition of Afghanistan (with map), is contributed by Herr F. von Stein. This number, besides the usual table of contents to the volume, contains a complete alphabetically arranged index to Dr. Behm's useful monthly summaries.

WE have received a specimen of the first number of one of those stupendous geographical works of which the French are so fond, and the best example of which is Elisée Reclus' "Géographie Universelle." Indeed, the new work announced seems to have pretty much the same object as that of Reclus, though the method is different. The new work is to be issued by the Librarie des Connaissances Utiles, and the author is M. Charles Hertz. Its title is "La Géographie Contemporaine d'après les Voyageurs, les Émigrants, les Colons, les Commerçants." It will consist of ten series of from three to five volumes each. We trust the publishers will find subscribers patient enough to wait for the end. There will be from 600 to 800 maps and hundreds of illustrations, and the work will be issued in weekly parts. We calculate it will take fifteen years to complete. Judging from the specimen, a good deal of narrative and adventure will be introduced into the work, and that it will be at least as entertaining as instructive. The first series will deal with polar and maritime expeditions, the second with Africa, the third with Asia, the fourth with Australia, and the fifth with means of communication, geographical societies, &c. The other five series will be devoted to a description of the nations of European origin and their enterprises over the globe. It is a grand scheme.

DR. THOLOZAN, physician to the Shah of Persia, is organising a scientific exploration of the province of Khuzistan, the southern province of Persia. The expedition will start from Bassorah on February 1 next.

NOTES

THE Corporation of the City of London having determined to identify themselves with the movement by the Livery Companies of London for the advancement of technical education, on Thursday last elected the following to serve on the Board of Governors of "The City and Guilds of London Institute for the Advancement of Technical Education":—The Lord Mayor *ex officio;* the Recorder, *ex officio;* Aldermen: Sir Thomas Dakin, Knt.; Sir Robert W. Carden, Knt.; Mr. William Lawrence; Sir Francis W. Truscott, Knt.; Sir Wm. A. Rose, Knt., F.R.S.L., F.R.G.S.; Simeon C. Hadley; Common Council: Mr. Joseph Beck, F.R.A.S.; Mr. W. Bassingham; Mr. J. L. Shuter, F.R.A.S.; Sir C. Reed, Knt., LL.D., F.S.A., Dep.; Mr. George Shaw; Mr. J. Edmeston; H. Lowman Taylor, J.P., Dep.; S. E. Atkins, Dep.; Sir Jno. Bennett, Knt.; Mr. Henry Greene; Mr. John Faulkner; Mr. Thomas Waller.

[1] The fact pointed out by Sir John Herschel in regard to the difference in the *velocity* of light on the undulatory and corpuscular theories, in the case of a luminous body moving directly towards or from the observer, would appear also to be worthy of remark. It is evident, for example, that in the case of a luminous body moving towards the observer, the velocity of light would *add* itself to that of the body on the corpuscular theory; but the velocity would be unaffected on the undulatory theory.

LAST week Dr. Gladstone read an important paper at the Society of Arts on science teaching in elementary schools. He assumed, first, that it is not good that poor children should go forth into the world in gross ignorance of the material objects among which they must always live and work; secondly, that it is far from desirable to try to make scientific men and women of boys and girls of twelve and thirteen years of age. "This earth," Dr. Gladstone said, "is our dwelling-place, from the cradle to the grave; our bodies are the complicated machines, so wonderfully made, by which every action of ours is performed; the sun, clouds, and atmosphere influence us every day; the animal, vegetable, and mineral kingdoms are ready to yield us their supplies; and the great mechanical and chemical forces, with heat, light, and electricity, are ready to be our servants if we do not allow them to become our masters. Every man, also, in his handicraft or trade, as well as every woman in her domestic duties, has to deal with some facts and objects of nature specially connected with them." Dr. Gladstone then proceeded to point out the present state of the question, showing that very much yet remains to be done ere science takes the place it ought to occupy in our elementary schools, though the energetic London School Board is doing much to give science-teaching an established place in the schools under their charge. He referred to the universality of science instruction in Germany, and expressed a hope that a "knowledge of common things" would soon take its place alongside of the older subjects in all our elementary schools.

WE are glad to learn that the health of Prof. Hoffmann, the well-known chemist, is now completely restored, and that he is again among his pupils.

M. FLAMMARION writes to us in reference to a note from a correspondent last week, that the subscription he is organising is mainly for the purpose of founding at Paris a free observatory created by private means, on the model of those which exist in England. It is desired to establish in the observatory the most powerful instrument which the funds will enable to be constructed. This instrument is intended above all for the physical investigation of the planets, and particularly of the moon, "the vital state of which," M. Flammarion writes, "may thus be definitely settled. It is not proved," he says, "that the moon is a dead planet, but the progress of optics appears to me to be now such as to justify a serious investigation for traces of life upon it; in fine, to settle what opinion ought to be held on the question of the habitability of the moon."

THE September number of the *Mineralogical Magazine and Journal of the Mineralogical Society of Great Britain and Ireland* contains three original papers. Mr. Sorby gives a few test-experiments of his new method of determining the refractive indices of mineral plates, which will hardly be new to readers of NATURE. Prof. Heddle continues his papers on the geognosy of Scotland. The present one is almost entirely occupied with the geology of the Island of Fetlar, and gives several analyses of the minerals found in its different rocks. Prof. How's contribution to the mineralogy of Nova Scotia is mainly taken up with mordenite and some altered nodules found at Cape Split; the rest of the paper is not much more than a list of localities. Ten pages are taken up by very poor abstracts from the *Zeitschrift für Krystallographie* and other periodicals, which are far inferior to those published in some of the weekly journals. Most of these are by a gentleman who may be a mineralogist, but is scarcely a crystallographer. He is grandly impartial as to notation, apparently following the authors in using either the Millerian or Naumannian. When using the former he often forgets to state the system in which the mineral crystallises. When the latter is used in an English mineralogical journal, the least we can expect is to have the Millerian equivalents given side by side with the Naumannian symbols. The conversion is not difficult, and tables for the purpose are given in all the text-books. Near the end is an abstract by the editor of a flattering notice of his own book, the good taste of which is obvious. We find it difficult to think that a magazine so indifferently conducted can prove either a commercial or a scientific success.

CAPTAIN HOWGATE has sent us some of the results of the preliminary United States Arctic Expedition in the *Florence*, in the shape of reproductions of photographs and of drawings by the Eskimo. The latter are rude, but vigorous and amusing, and show the well-known talent of the natives for drawing.

EXPERIMENTS on the electric light, with Jablochkoff candles, have been tried at Havre, and, in consequence of the frequency of maritime collisions, are attracting much notice from seamen. The *Breeze*, one of the British mail steamships, was stranded a few days ago, when trying to enter the Calais port, owing to the prevalence of fogs. This accident would not have taken place if an electric light had been placed at the end of the jetty, as had been proposed. It is said the matter has been reported to the French Minister of Public Works. The electric light experiments in the Avenue de l'Opera and in front of the Palais Legislatif are to be continued up to January 15, but at the expense of the company, the Municipal Council having refused to pay more than the sum which would have been spent by them if the streets had been lighted with ordinary gas.

THE question of "reserves" for the aborigines having been recently raised in the Queensland Legislature, it has been recommended that the system of the Durundur reserve should be extended, as there are many other places where it might be advantageously tried.

WE have received from Messrs. De la Rue several specimens of their diaries, which are marked by all their usual elegance and usefulness. Much valuable information is prefixed to several of the diaries, though we still regret the absence of some of the astronomical information which used to give them a distinctive value. Messrs. Letts have also sent us a number of their various forms of diaries, the marked feature of which is their utility. They are of all sizes and prices, and no one need have any difficulty in providing himself with this useful help to order and memory. Messrs. Letts have also published a handy weather table by Mr. Saxby, containing a great deal of useful and well-arranged information.

THE *Madras Mail* states that great progress is being made in the cultivation of chinchona in the Wynaad, and that nearly a million plants have been taken there this year from the Neddiwuttum estates, and this is in addition to what is obtained from the extensive chinchona nurseries on all the coffee estates. All the poorer parts of these are being planted with chinchona which is found to thrive well where coffee will not grow.

A LETTER from Peking states that the Viceroy Li Hungchang has entered into a contract with Mr. Arnold Hague, of New York, an able geologist and mining expert, for the purpose of prospecting the gold, silver, and other mines in the north of China. Mr. Hague is expected to start shortly from Tientsin for the mining regions. The just published Consular Report from Canton also states that General Fang, a well-known military officer, has been instructed to arrange for an immediate supply of European machinery to be used in local mines. It appears to be thought that there is great likelihood of the early working of coal and other mines in the provinces of Chihli, Kiangsi, Kiangsu, and Szechuen.

FOR some time past there has been so little water in portions of the Grand Canal of China, that it has only been navigable by

small boats, and for this reason, among others, it has been found necessary to send the grain tribute up to Peking by sea. The last mail from China, however, brings news of an unusual rise in its waters. A correspondent of the *North China Herald* left Tientsin on October 10 and observed no especial increase in the water until he reached the town of Hsingchi, about seventy miles to the south. There he met with a south-west wind, and noticed the water up to the top of the banks. Further on the people were seen raising narrow ridges to prevent the water from overflowing into the fields. Beyond the city of Tsingchow, and as far as the Narpi district, large tracts of land were under water. The general level of the country east of the canal is about six or eight feet below the artificial embankment, and in not a few places this is very weak from the constant wash, especially at the bends, so that the danger is serious. The writer had not been able to learn the cause of this unusual and rapid rise in the Grand Canal, but the Chinese attribute it to heavy rains in the mountainous region to the south-west, though it has never been known to happen before so late in the year.

THE Board of Trade having received, through the Foreign Office, reports from Her Majesty's Consul at Taganrog as to the recent destruction of corn crops in the neighbourhood of that place by a beetle described as the *Anisoplia austriaca*, have communicated with the Entomological Society of London, and have been favoured by that Society with a report upon the subject. The Report is signed by Messrs. McLachlan and Waterhouse, who state that the insect *Anisoplia austriaca* has nothing whatever to do with the "Colorado beetle." It belongs to a group of beetles (Rutelidæ) allied to our common cockchafer, but is of very much smaller size. There can be no doubt, they state, that the eggs are deposited in the earth at the roots of corn and grasses, that they soon hatch, and that the larva feeds upon the roots. How long a period elapses before the pupal state is assumed they know not, but they think that two years may be the outside limit, and that in the autumn of the second year of its existence, the larva either forms a cocoon in which it remains quiescent until the following spring, when it assumes the pupal state, or, as is more probable, it assumes that state in the autumn, and the perfect insect may be developed soon afterwards, but remain in the cocoon until the following summer. All accounts, however, they have been able to refer to concerning this and congeneric species, agree (as does the information furnished by Mr. Carruthers) in attributing the chief damage to the perfect insect, which feeds upon the green corn in the ear. After referring to the abundance of the beetle in some parts of Germany, they commend, as a preventive of its ravishes, rotation of crop and encouragement of insectivorous birds, and state their opinion that there is no reason to apprehend the recurrence year after year of such multitudes of the beetles as have occasionally appeared. "In the present state of entomological science," they conclude, "it is impossible to accurately account for visitations like this, which occur with many insects, injurious or otherwise. It may be that the pupal condition is prolonged indefinitely, or until circumstances favour its determination; by this reasoning (which is warranted by what we know to be the case in some other insects) the pupæ might be accumulated from year to year, and the perfect insects from these accumulations burst forth simultaneously."

AT the second monthly meeting of the Statistical Society, held on the 17th inst., Dr. Mouat, Foreign Secretary of the Society, who was deputed to represent it at the meetings in Paris of the Demographic Congress, and of the Permanent Commission of the International Statistical Congress, and, in Stockholm, of the International Penitentiary Congress, read reports of the proceedings of those bodies, so far as they were of interest to the Statistical Society. The chief work of the Permanent Commission was its own reorganisation as the executive of the Statistical Congress, and the adoption of a scientific scheme of classification of statistics for international purposes. Statistical annuals for 1877 have been published in France, Italy, Prussia, Austria, Hungary, and Belgium, all differently arranged. With a view to the adoption of uniformity of system on strictly scientific principles, M. Deloche, the chief of the General Statistical Department in Paris, suggested such a system, and it was adopted. Taking territory and population as its basis, the subsequent grouping of the many and varied facts by which human activity is manifested was in the order of the faculties to which they naturally attach themselves, viz., the moral, the intellectual, and the physical. Reference was made by Dr. Mouat to the large amount of valuable statistical information collected and published annually in the form of the statistical abstracts of the British Empire; and to the mass of miscellaneous statistics furnished from time to time to Parliament. Dr. Mouat was of opinion that the time had not yet arrived for the scientific classification of statistics, and he suggested for consideration a more simple form under four heads, viz., (1) Territory and Population; (2) Revenue and Commerce; (3) Laws and Government; and (4) Miscellaneous Statistics, containing all that cannot be grouped under any of those heads. The Demographic Congress was entirely devoted to the consideration of questions of population in the aggregate, or the natural history of society, as distinguished from physiology—births, deaths, marriages, migrations, &c.

THE *Times* a few weeks ago gave prominence to some facts showing the highly electrical condition of the atmosphere in Canada during the fine dry winter there. A letter from Mr. A. H. McNab, of Teignmouth, in the *Western Times* of December 17, will show that similar conditions exist in England during similar weather. He says:—"About 7.45 P.M. on Friday I was crossing Shaldon Bridge from the Teignmouth side, and immediately after passing the 'drawbridge' I was much surprised to find both sides of the bridge illuminated at certain regular distances with pale blueish lights resembling flickering lamps. My first impression was that, owing to the dense fog that prevailed, some sort of lamps had been placed on the bridge as a warning for the boats and barges passing up and down the river, but on coming to the first iron upright in the bridge railing I at once came to the conclusion that the light was electrical, for each point of iron had a flame of about two inches in height, composed of electric sparks issuing from it, accompanied by a hissing sound resembling that caused by the escape of gas from unlighted burners, and all the iron points along the bridge were similarly illuminated, producing a most charming effect. The point of the umbrella which I carried was also emitting a light, and when moved about produced sparks and sound. When I was midway across the bridge a passenger suddenly appeared in the fog and called out to me, 'Sir, your umbrella has a light on the end of it.' His surprise, however, was not lessened when I informed him that his own umbrella had the same. So far as I observed the phenomenon was entirely confined to the bridge, and on my return some time after it had entirely disappeared. Perhaps the large amount of iron in the bridge may have something to do with it."

THE mission of Sergeant Jennings, of the United States Signal Corps, has not been quite fruitless in Paris. A sort of weather indicator has been placed, by order of the Prefect of the Seine, at the doors of the Luxembourg Palace; others will, it is said, be very shortly installed in several places of Paris.

AS No. 1 of "Dimmock's Special Bibliography" (Cambridge, Mass.) we have received a descriptive list, arranged according to date, of the Entomological Writings of Prof. John L. Le Conte, compiled by Mr. S. Henshaw. There are 150 entries, and the list seems compiled with great care and must prove useful to entomologists.